REMARKS

The present invention is in a highly competitive industry of manufacturing double spiral glass tubes that can form arc tubes in, for example, a fluorescent lamp. As can be appreciated, the relatively high cost of energy and the necessity to conserve natural resources has created a greater demand for compact fluorescent tubes that can replace the wasteful incandescent light bulbs. Major international companies are involved in providing such products with numerous highly skilled scientists and engineers. It has been known that problems exist in providing increasingly small and compact helical wound glass tubes that would be suitable for use as an arc tube in such lamps.

The present invention enables a highly compact lamp that can provide at least the same luminous flux of conventional arc tubes with a lamp efficiency improvement of 13% and a rated life improvement of approximately 10% as set forth in our specification at page 46. Additionally, the significant problem of defective tubes that, in the past, have sometimes reached a fail rate of 50% has now been addressed by the present invention and a trial, instigated to simulate mass production, resulted in an increase of usable product with a resulting yield of 98.9%, see page 41 of our specification.

These improvements have occurred by providing predetermined lengths of straight glass tubes with the end portions of such tubes supported while heating an intermediate portion of the glass tube to a temperature above the softening heat range of the glass tube. For example, for a glass tube of a characteristic of softening in a temperature range of 670-690°C, the intermediate tube portion can be heated within a furnace to a temperature of about 770°C. The intermediate glass tube is not supported and can sag under its gravity weight as shown, for example, in Figures 8A - 8C of our present drawings. Mounted beneath our furnace and aligned with the

positioning of our sag is a mandrel that can capture a central portion of the sag as shown in Figures 10A - 10C. The end portions of the glass tube can be held within chucks 197 and 198 and the chucks can be aligned so that the straight portion matches the helical angle of the winding mandrel. Additionally, the chucks can restrain the movement of the end portions to provide an appropriate range of tension to ensure that the tube diameter of the sagging portion is maintained at a consistent size. That is, it is neither increased, which has been a problem in the prior art, nor is it decreased.

Thus, the relative ratio of the moving speed of the chucks relative to the rotational speed of the mandrel can be held within an appropriate range. This can vary depending on the specific dimensions or diameter of the glass tube. The mandrel itself can be heated to facilitate the formation of the arc tube through the intermediate sagging portion and appropriate gas pressure can also be applied.

It is believed that a significant novelty in the manufacturing of a glass arc tube in a highly efficient manner has been achieved in a relatively crowded and competitive field. These features should be taken into consideration in determining the patentability of the present invention.

> "Thus when differences that may appear technologically minor nonetheless have a practical impact, particularly in a crowded field, the decision-maker must consider the obviousness of the new structure in this light."
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> *Continental Can Co. USA Inc. v. Monsanto Co.*, 20 U.S.P.Q. 2d. 1746, 1752 (Fed. Cir. 1991).

The Office Action raised an issue with regards to Claim 8 under the first paragraph of 35 USC § 112.

The Examiner correctly notes that the chucks approach each other rather than diverge away from each other during the winding of the intermediate portion of the glass tube on the mandrel. Claim 8, however, depends from Claim 7 and Claim 7 defines positioning the sagging glass portion or the double spiral scheduled portion so that it is initially parallel with the winding grooves before the mandrel is rotated. Claim 8 further defines how this positioning occurs and this can be compared between Figures 10B and 10C of our drawings. Initially the sagging glass tube is inserted within the holding portions at the top of the mandrel and then the chuck units are moved from the position in Figure 10B to the position in Figure 10C. As such, they are positioned further apart from each other since the sagging portion is now aligned with the straight end portions.

Thus, we are not referring to the process of rotating the mandrel but rather the preliminary positioning disclosed in Figures 10B and 10C. We believe with this explanation it can be appreciated that while the Examiner is correct in the observation about the movement of the chucks and the end portions of the glass tube during the winding step of the mandrel, that Claim 8 is not directed to that feature of the invention.

If there are any further questions with regards to this matter the undersigned attorney can be contacted at the below listed phone number.

The Office Action contended that Claims 1, 4-7, 12 and 16 were anticipated by the Greiner US Patent No. 2,491,857. Additionally, it was contended that the dependent Claims 2, 3, 9-11, 13-15 and 17 were obvious over the Greiner disclosure under 356 USC § 103.

Claim 8 was not rejected over prior art and presumably represents allowable subject matter since applicant has now addressed the 35 USC § 112 issue.

> "'[T]he dispositive question regarding anticipation is whether one skilled in the art would reasonably understand or infer from the prior art reference's teaching that every claim [limitation] was disclosed in that single reference.' *Dayco Prods., Inc. v. Total Containment, Inc.*, F.3d 1358, 1368 (Fed. Cir. 2003).

Claim 1 has now been amended and defines a relationship between the heating furnace and the softened glass tube so that a mandrel is positioned below the heating furnace and the hanging and holding step lowers the softening glass in a substantially perpendicular manner from heating furnace thereby accommodating the sagging softening glass tube so that it can be positioned on the top of the mandrel. See again, Figures 10A and 10B of our present drawings. As can be readily appreciated, this manufacturing method permits the softened glass tube to be moved downward from the heating furnace and thereby reduce any swaying of the sagging softened glass tube, as it is moved, in a direction perpendicular to the top of the mandrel. Thus, the glass tube can be hung with a part thereof held on top of the mandrel with out any excessive force applied to the glass tube.

While the particular form of the heating furnace can be varied, the advantages of our present invention can be readily determined from our own specification starting at line 6, page 50 through line 23. Thus, even when the softened glass tube is being vertically moved, a central portion of the glass tube, sagging due to its own weight, would be aligned in the same direction as the movement of the glass tube. As can be readily appreciated, the importance in the timing both to increase production and to take advantage of the heated range of the glass tube is facilitated by an arrangement defined in the manufacturing method of Claim 1.

The Greiner reference is directed to a process of heating and roughly winding an entire length of glass tube into a coiled configuration at an operator station. Referring, for example, to

Figure 2, an operator can cause an electric oven 1 with a hemispherical refractory block to be rotated upward after it has heated an entire length of the tube 4. As described on Column 1, line 23-20 as follows:

> To this end apparatus is provided for heating the full length of the vitreous body to a workable state, which apparatus assures even distribution of the heat over the entire periphery of the vitreous body, and for manipulating said vitreous body to bend it rapidly into engagement with a form without otherwise changing the shape thereof.

A stock glass tubing 2 is positioned directly over rollers 4 and 5 which rotate the tube cylinder while being heated. As described in Column 4, the glass tube is heated to a "workable condition, although not so hot as to cause it to collapse." Column 4, line 65-66. Presumably, sagging would be considered a form of collapsing.

The oven is rotated upward and the operator pulls down the handle 23′ so that the plate supporting the rollers are moved and roller 5 rotates upward and pushes the glass tubing 2 over the roller 4. This causes the glass tube to contact the chute 40 so that the glass tube rolls away from the raised furnace to drop into a transverse groove 43. The operator then rotates a hand crank 45, shown in Figure 1, in the following manner:

> The bending operation is immediately brought about by the operator to avoid cooling of the glass tubing 2 by fairly rapidly rotating the crank 45 which causes a counter-clockwise rotation and gradual raising of the form 3.
>
> Column 5, lines 36-40.

As a result, a rotational and upward movement of the form 3 rapidly rotates the entire glass tube into the shape shown in Figure 4. A tray supports the ends of the glass tube. Referring to Figure 11, guide roller 75′ prevent the glass tube from rotating with the mandrel and thereby enables the entire tube to be bent into the helical configuration.

This entire bending operation is brought about by the rapid rotation of the crank to avoid any potential loss in heat and improper bending of the tube.

In Column 7, lines 52-65, Greiner further teaches a post bending procedure where a gas pressure can be applied after the finish of the bending step. This gas pressure is to cause an expansion of the tube to remove any "wrinkles or vertical or horizontal flattening" particularly in the inner wall of the helix.

Finally, Greiner teaches also initially applying a fluorescent coated tube with electrodes and then evacuating the tube as it is being formed and rotating. As described, this configuration of a fluorescent tube is still heated in the same manner as described with regards to the initial embodiment in the oven. Again, the oven is used to heat the entire length of the glass tube envelope. See Column 9, lines 10-16.

> A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would be lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984).
>
> MPEP 2141.02

As can be readily appreciated, the Greiner reference is designed to support and heat the entire length of the glass stock and to rapidly eject it down an inclined slope 40 to permit an operator to hand rotate a crank in a rapid fashion to form the coiled tube. The elongated glass tube is supported and rotated by rollers and the concept of heating only an intermediate portion at a temperature above a softening state that would permit the sagging of the tube is certainly not contemplated nor taught by the Greiner reference. Likewise, the Greiner reference is not releasing a heated sagging tube to extend downward in a perpendicular direction for mounting on the top of a mandrel but rather it rotates down a chute after the furnace is rotated away from the

tube. The tube is not only fully supported but is intended to roll down the chute. Our manufacturing method to increase productivity and output is not taught in the procedure suggested in the Greiner reference and in fact the teaching of the Greiner reference would lead away from the advantages of our present invention. As can be appreciated, our present application and claims have our glass tube move downward thereby preventing the glass tube from any swaying and we align the top of the mandrel so that the glass tube can be hung from the top of the mandrel without the application of an excessive force to the softening glass tube.

In referring to our dependent claims, we define a heating of at temperature of 150°C over any softening point and in fact to the extent that the glass tube will sag. Imagine rolling a glass arc tube with unheated end portions and a sagging middle portion on the chute of the Greiner reference.

Our dependent claims further define, for example, holding the ends of the tube in a substantially horizontal position and as can be appreciated, we can also provide a sufficient amount of torsion force to maintain a desired tube diameter.

As set forth in Claim 6, we heat the glass tube so that a portion in the vicinity of the center of a double spiraled scheduled portion will sag downward.

Additionally, we have bent the ends of the glass tube to form a position parallel with the winding grooves. As can be appreciated, the Greiner reference uses a tray to hold the glass tube in a horizontal position while moving, with a hand cranking rotation, the mandrel upward through the tray.

A alternative embodiment showing belts 105 and 106 apparently sets the winding speed of the mandrel at approximately the same speed as the belts 105 and 106 as recognized by the Office Action.

Referring to Claim 10, we define a first speed for the glass tube being wound around the mandrel in the winding step to be higher than a second speed at which the chuck units holding the end of the glass tube are moved. This permits us to provide appropriate tension and to prevent the glass tube from loosening from the mandrel. We are also able to maintain the original cross section of the glass tube even after the winding process. The Greiner reference would appear to suggest, even if there was no loosening, that any softened glass tube placed on the belts 105 and 106 could become flat. This perhaps explains why a gas pressure is applied, after the formation step, to try and remove such a problem.

Referring to dependent Claim 11, we define a particular ratio of speeds within a range of 0.6 to less than 1.0 that is certainly not contemplated nor taught in the Greiner reference. It should be noted that the Office Action acknowledges that various other features are not taught by the Greiner reference including our temperature range except the Office Action contends that it would desirable to have an even temperature distribution along the entire length of the stock glass tube.

As can be appreciated, our invention further calls for heating an intermediate portion to the extent that it will sag which apparently would be at a higher temperature than contemplated by Greiner. The Office Action further acknowledged that Greiner does not teach a particular rate of winding higher than at a rate at which the chucks advance. The Office Action contended, however, that Greiner would hope to not have any deformation but it is clear that the deformation solution is a post winding step of increased gas pressure to change the dimension and remove kinks or flattening. This is not the same solution nor does it provide the same advantages of our present invention.

Every manufacturer wants to maintain a desired constant dimensional configuration but the issue is the method to achieve this desire and the method presented in our claims is neither taught nor suggested by Greiner or any other reference of record. Accordingly, it is submitted that our dependent claims provide additional features that are neither suggested nor taught in the Greiner reference.

The newly drafted Claim 20 further teaches heating an intermediate tube portion until it is soft enough to sag by gravity forces while holding and supporting the respective end portions of the glass tube. The sagging intermediate portion is then lowered to engage a mandrel with grooves representative of a double spiral configuration and the heated glass tube is then wound to provide the double spiral configuration. The dependent claims 21-23 also define features neither taught nor suggested in the Greiner disclosure.

As can be readily appreciated, the features set forth in our claims, including the dependent claims, provide a particular result effective parameter to achieve significant advantages in production rates of final finished product.

As can be appreciated, the more that the cited reference must be modified to meet the outstanding claim and the more that there is a reliance upon matters of purported knowledge of a person of ordinary skill in the field, there is a suggestion that perhaps hindsight may have been involved in formulating the rejection. This can be particularly true for an Examiner who is attempting to provide a diligent effort to ensure that only patentable subject matter occurs. The difficult issue is to step back from the zeal of the examination process and to appreciate that the Patent Examiner has to wear both hats of advocating a position relative to the prior art, while at the same time objectively rendering in a judge-like manner a decision on the patentability of the present claims. In the present rejection, it is believed that above comments have more than

adequately demonstrated that there is in fact a novel invention in a relatively crowded field that is defined by our current claims.

> A particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977) (The claimed wastewater treatment device had a tank volume to contractor area of 0.12 gal./sq. ft. The prior art did not recognize that treatment capacity is a function of the tank volume to contractor ratio, and therefore the parameter optimized was not recognized in the art to be a result-effective variable.).
>
> MPEP §2144.05 (II)(B) (underline added)

It is believed the case is now in condition for allowance and an early notification of the same is requested. If the Examiner believes a telephone interview would help further the prosecution of this case he is respectfully requested to contact the undersigned attorney at the below listed number.

Very truly yours,

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